U.S. Department
of Transportation
Research and Special
Programs Administration

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Transit Management Student Guide

Prepared for:

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Module 1: Introduction to Intelligent Transportation Systems (ITS) and Advanced Public Transportation Systems (APTS)

TRANSIT MANAGEMENT TRAINING ROADMAP

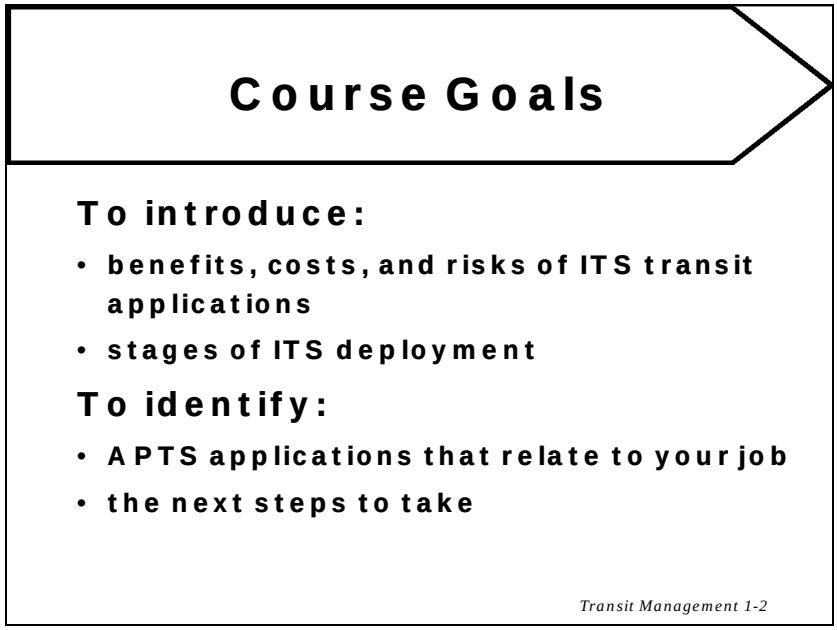
	Module 1: Introduction to ITS and APTS
	Module 2: Automatic Vehicle Location Systems
	Module 3: Automated Transit Information
	Module 4: Transit Telecommunications
	Module 5: Transit Operations Software
	Module 6: Paratransit Computer-Aided Dispatch
	Module 7: Electronic Fare Payment
	Module 8: Technologies for Small Urban & Rural Transit Systems
	Module 9: Stages of ITS Project Deployment
	Module 10: What Can ITS Do for Me?

- Intelligent Transportation Systems
- Advanced Public Transportation Systems

Module 1: Introduction to ITS and APTS

Introduction

Slide:
Course Goals



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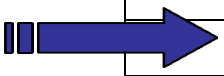
Introduction, Continued

Where this course fits in

This course, Transit Management, fits in to the Intelligent Transportation Systems Professional Capacity Building (ITS PCB) classes as shown in the table below.

ITS Courses
Awareness Seminar
Intelligent Transportation Systems Awareness Seminar
Overview Technical Seminars
ITS and the Transportation Planning Process
ITS Telecommunications Overview
Shared Resources for Telecommunications
ITS Telecommunications Analysis
ITS Public/Private Partnerships
ITS in Transit
ITS Systems Engineering/Architecture
ITS/CVO Awareness Seminar
Innovative Finance Strategies for Deploying ITS
Short Courses
Deploying Integrated Intelligent Transportation Systems
Using the National ITS Architecture for Deployment
Transit Management Course
Advanced Transportation Management Technology Workshop



See your student guide Appendix D for more information on these classes.

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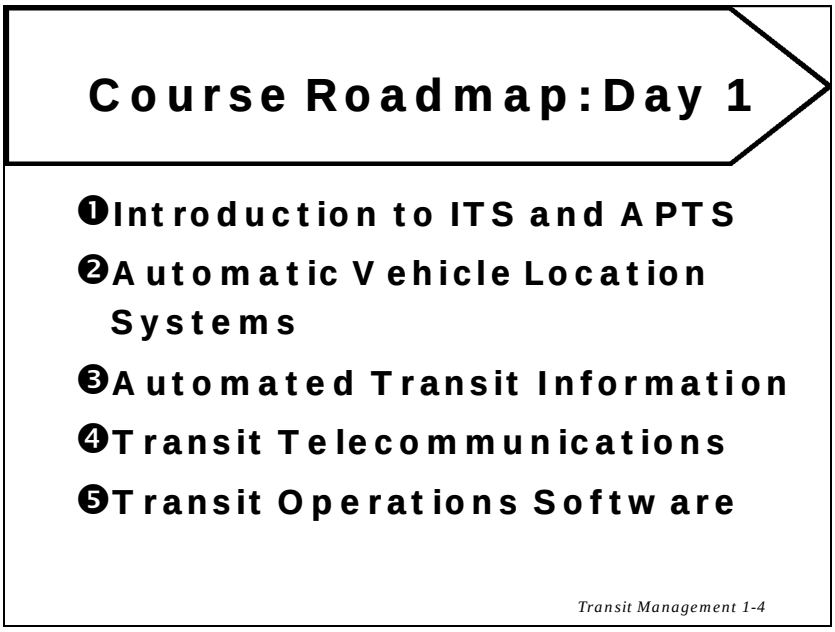
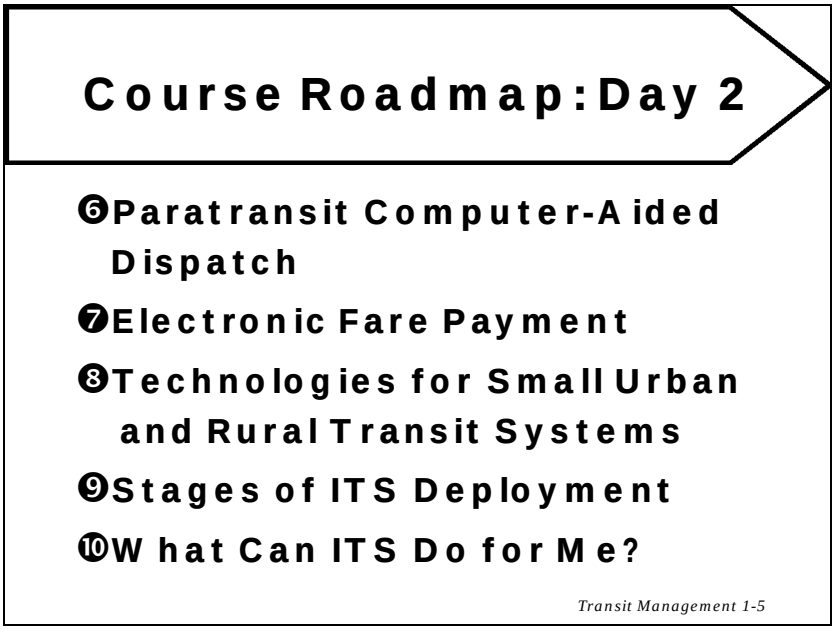
Introduction, Continued

Slide: Course Roadmap: Day 1



Slide: Course Roadmap: Day 2



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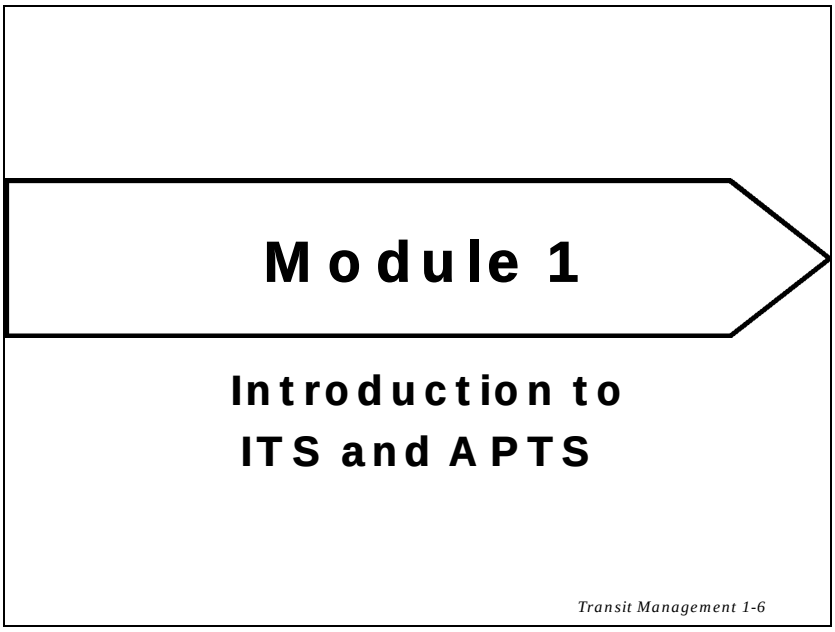
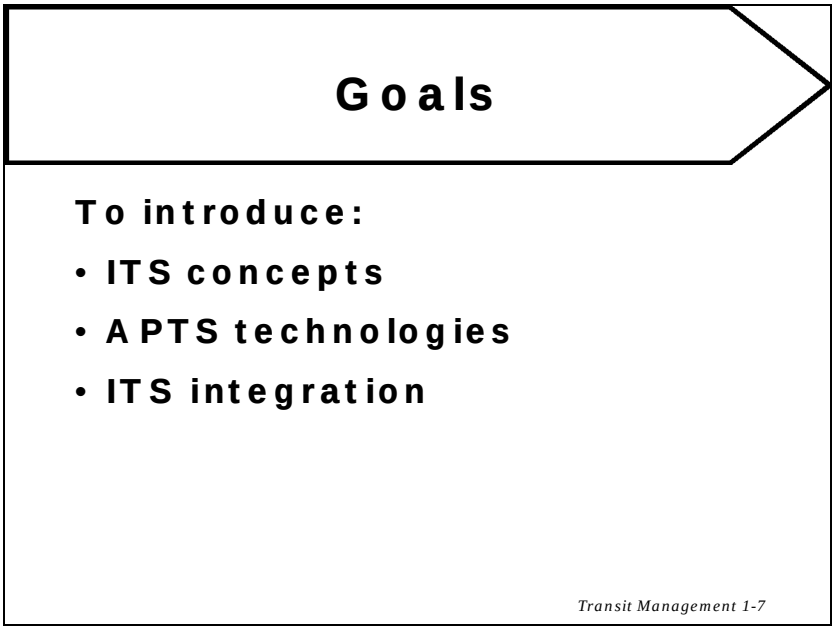
Introduction, Continued

Slide:
Module Title



Slide: Goals



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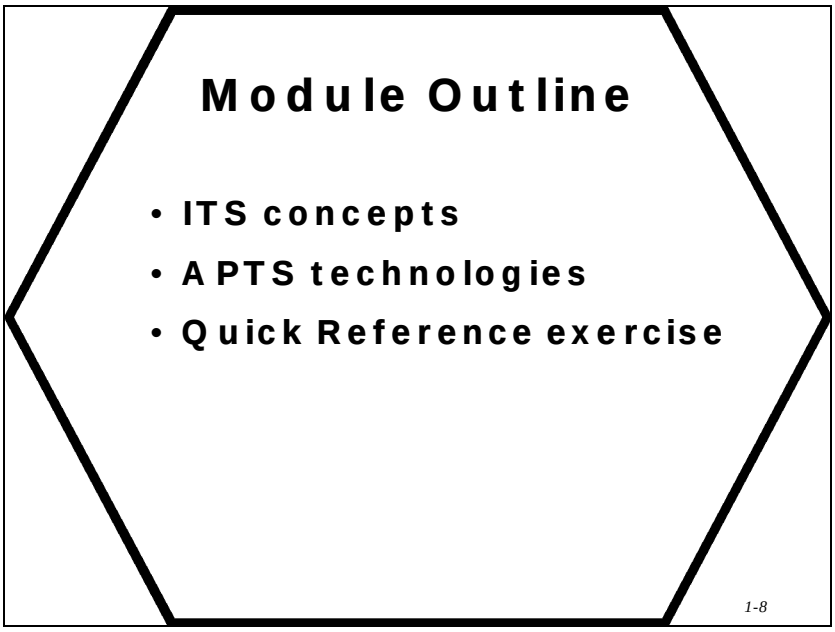
Introduction, Continued

Module objective

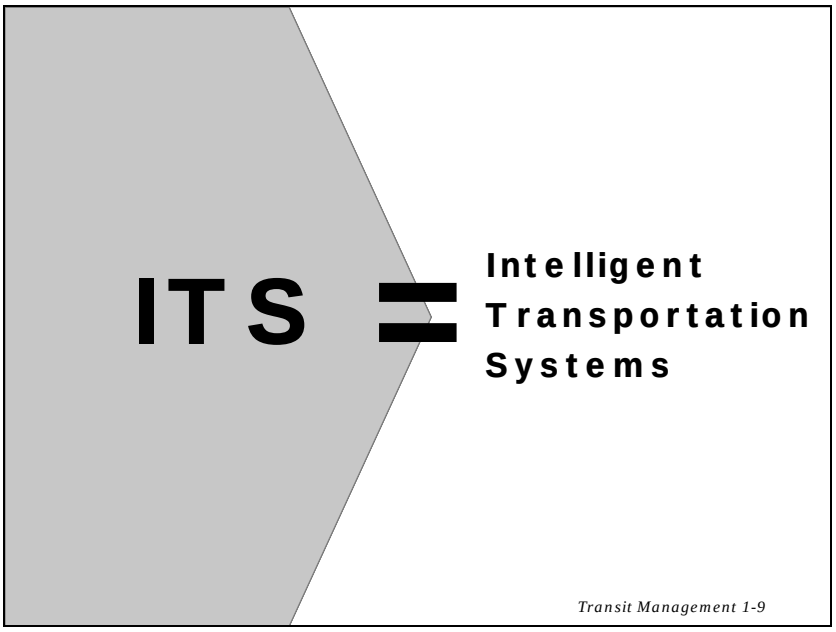
Given an APTS Technology Reference table, students will discuss and select transit technologies that are of most interest to them.

Slide: Module Outline



ITS Concepts

Slide: ITS



What is ITS?

Intelligent Transportation Systems (ITS) are advanced technologies and applications currently being applied to solve transportation challenges.

The ITS program is sponsored by the U.S. Department of Transportation (DOT) through the ITS Joint Program Office (JPO), Federal Highway Administration (FHWA), and the Federal Transit Administration (FTA).

- These organizations provide technical assistance to public transit authorities as they plan and implement ITS projects.

Web site: *www.its.dot.gov*

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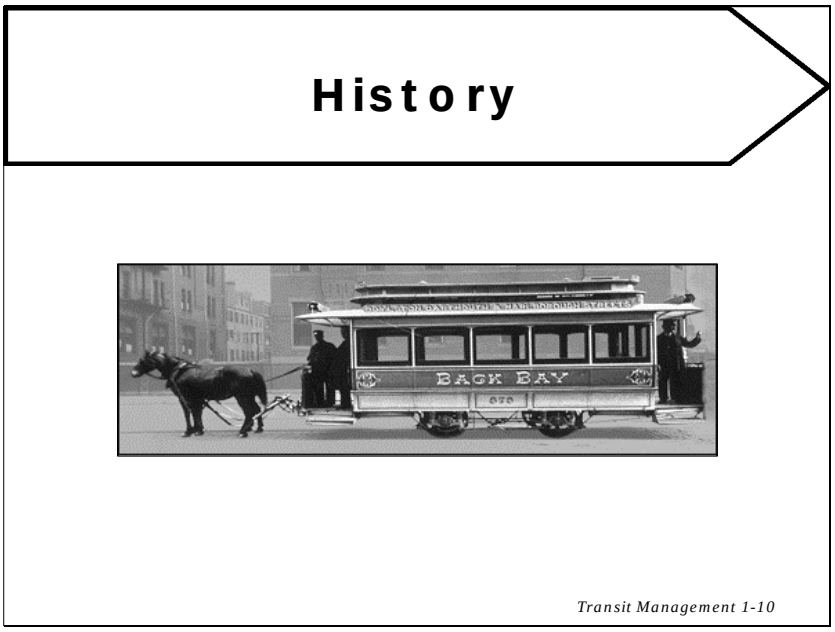
ITS Concepts, Continued

Slide: History



History of ITS

ITS, formerly known as the Intelligent Vehicle Highway Systems (IVHS), came to be as a result of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. ISTEA brought unprecedented increases in authorized spending for transit.

- January 1996: Then Secretary of Transportation Frederico Peña launches "Operation TimeSaver," which seeks to install a Metropolitan Intelligent Transportation Infrastructure in 75 major U.S. cities by 2005.

- June 1998: The Transportation Equity Act for the 21st Century (TEA-21, Public Law 105-178) was signed into law, re-authorizing the federal surface transportation program until the year 2003.

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ITS Concepts, Continued

Slide: ITS America

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ITS Concepts, Continued

ITS America

ITS America:

- is the only Congressionally-mandated, national, public/private organization established to coordinate the development and deployment of ITS in the United States
- is a single, coordinating organization which serves as a clearinghouse for ITS-related information, and as a forum through which public and private-sector stakeholders can work to meet today's challenges
- has the mission to foster public/private partnerships that will increase the safety and efficiency of surface transportation through the accelerated development and deployment of advanced transportation systems
- includes members from federal, state, local and foreign government agencies; national and international corporations; universities, independent research organizations, public interest groups, and other organizations with an abiding interest in solving the nation's transportation problems through the use of ITS technology
- has an APTS committee under it

A projected $400 billion will be invested in ITS between now and the year 2011.

- 80% of that investment will come from the private sector in the form of consumer products and services.
  - ◊ Where does the money go?
  - ◊ How is ITS deployed?

Web site: *www.itsa.org*

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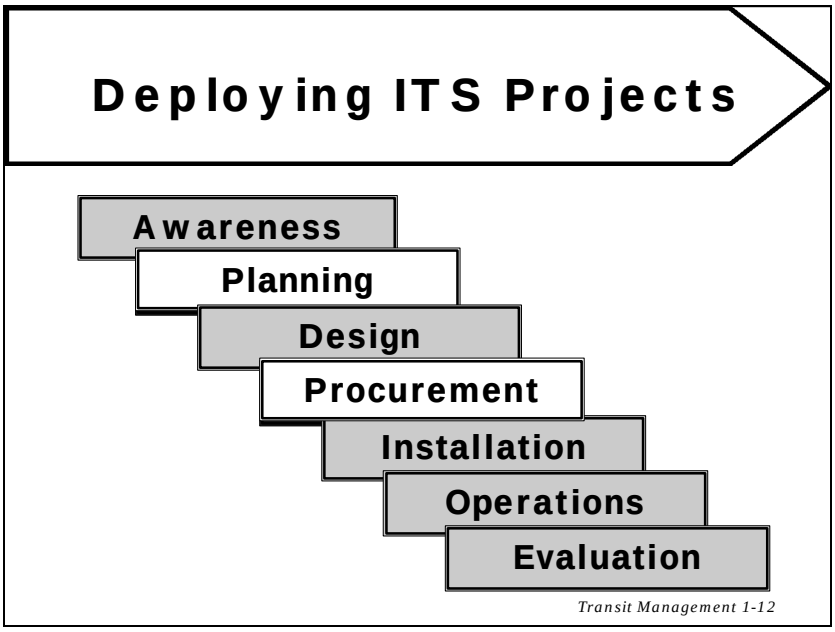
ITS Concepts, Continued

Slide: Deploying ITS Projects



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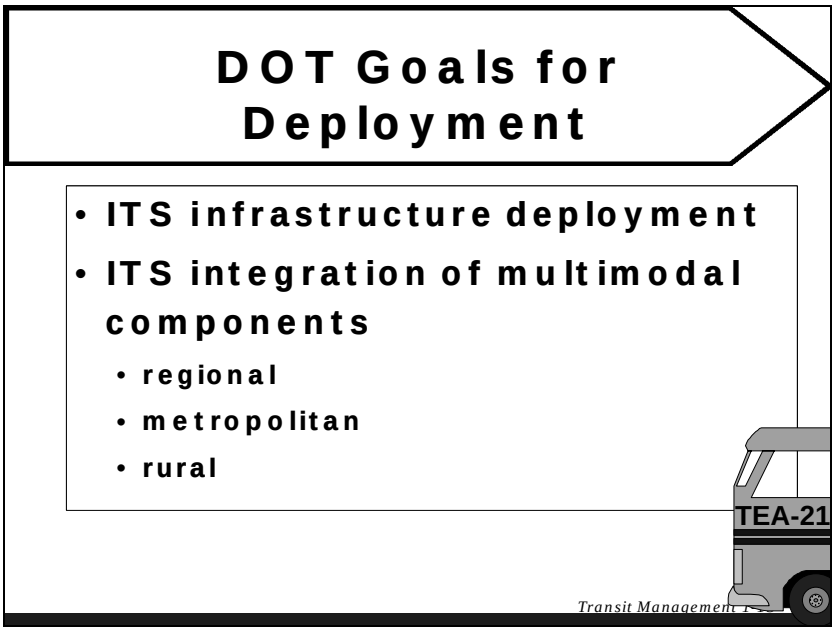
ITS Concepts, Continued

Slide: DOT Goals for Deployment



Goals for deployment

The ITS deployment program authorized in TEA-21 contains funding for ITS integration of multimodal ITS components in:
- large regional or multi-state areas
- metropolitan areas
- rural areas

Source: Federal Report to the ITS America Board of Directors, April 22, 1999

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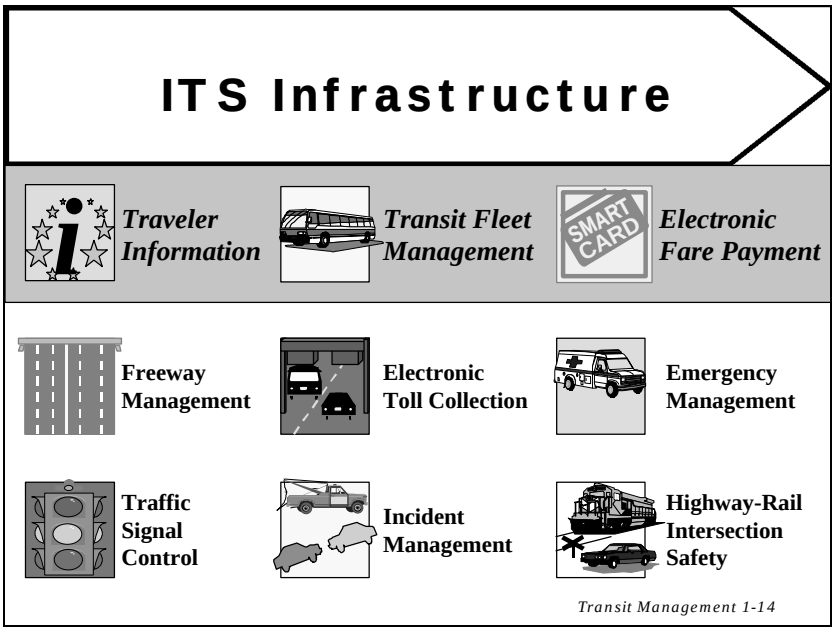
ITS Concepts, Continued

Slide: ITS Infrastructure



ITS Infrastructure and transit

Integration of the nine components of the Metropolitan Intelligent Transportation Infrastructure is critical to the efficient management of regional transportation systems.

This course focuses on the three components that are central to Advanced Public Transportation Systems (APTS):

- transit fleet management
- traveler information
- electronic fare payment

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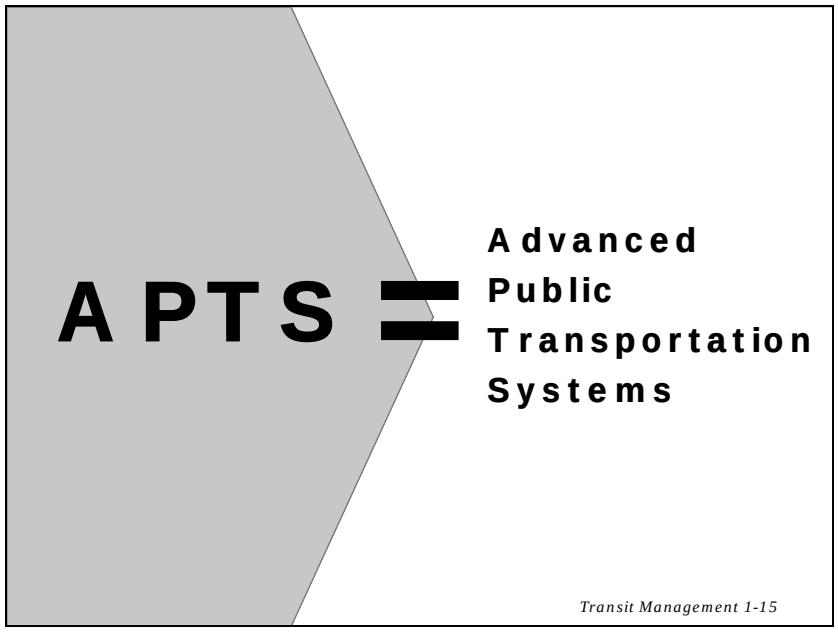
ITS Concepts, Continued

Components of the ITS infrastructure	
Transit fleet management	enables more efficient transit operations, using enhanced passenger information, automated data and fare collection, vehicle diagnostic systems and vehicle positioning systems
Traveler information	linked information network of comprehensive transportation data that directly receives transit and roadway monitoring and detection information from a variety of sources
Electronic fare payment	uses multi-use traveler debit or credit cards that eliminate the need for customers to provide exact fare (change) or any cash during a transaction
Traffic signal control	monitors traffic volume and automatically adjusts the signal patterns to optimize traffic flow, including signal coordination and prioritization
Freeway management	provides transportation managers the capability to monitor traffic and environmental conditions on the freeway system, identify flow impediments, implement control and management strategies, and disseminate critical information to travelers
Incident management	quickly identifies and responds to incidents (crashes, breakdowns, cargo spills) that occur on area freeways or major arteries
Electronic toll collection	uses driver payment cards or vehicle tags to decrease delays and increase roadway throughput
Highway-rail intersection safety	coordinates train movements with traffic signals at railroad grade crossings and alerts drivers with in-vehicle warning systems of approaching trains
Emergency management	focuses on safety, including giving emergency response providers the ability to quickly pinpoint the exact location of an incident, locating the nearest emergency vehicle, providing exact routing to the scene, and communicating from the scene to the hospital

APTS Technologies

Slide: APTS



APTS

APTS is the acronym for Advanced Public Transportation Systems. APTS refers to the transit components of Intelligent Transportation Systems (ITS).

Web site: *www.fta.dot.gov/library/technology/APTS/t_its.htm*

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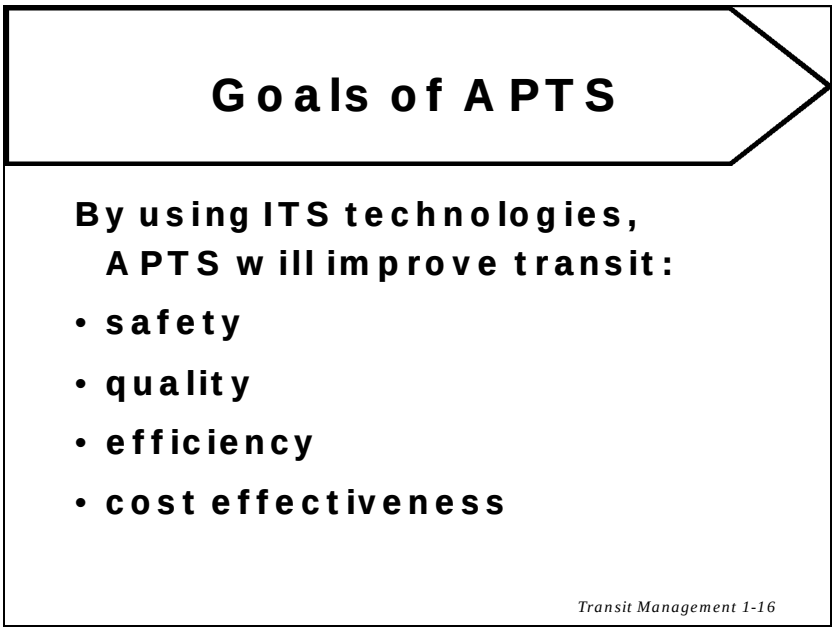
APTS Technologies, Continued

Slide:
Goals of APTS



Goals of APTS

The goals of the APTS program are to improve transit safety, quality, efficiency, and cost effectiveness.

APTS has:
- recognized the importance of increasing public knowledge about transit technologies including advanced navigation, information, and communications technologies in operating models
- made public transportation user friendly

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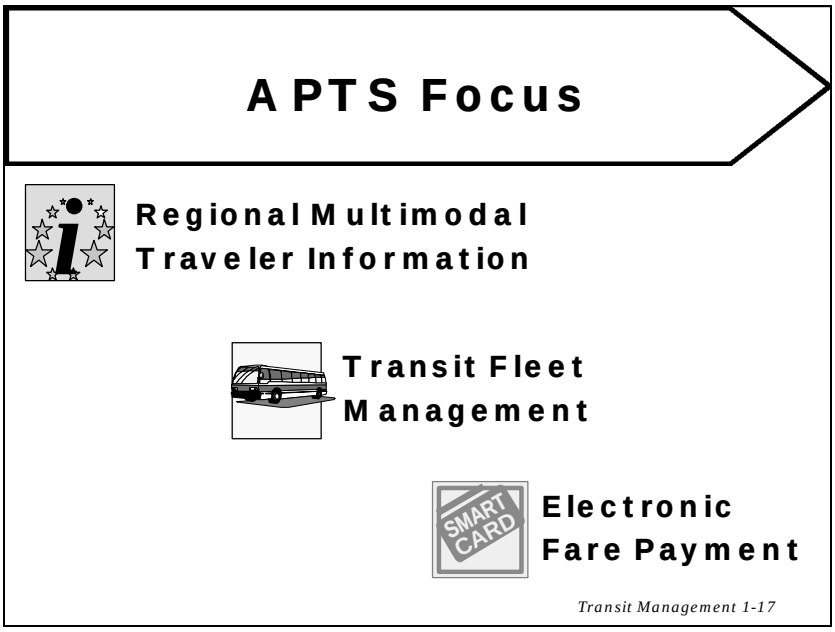
APTS Technologies, Continued

Slide: APTS Focus



APTS focus

APTS focuses on three of the nine components of ITS:
- Traveler information
- Transit fleet management
- Electronic fare payment

Traveler information

Information on multiple transportation modes (e.g., bus, rail, private vehicle) assists in decision making for more efficient transit use. This leads to increased customer satisfaction and ridership.

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APTS Technologies, Continued

Transit fleet management

Transit fleet management uses ITS to increase ridership by improving driver/operator and passenger safety and the efficiency and effectiveness of services by focusing directly on vehicles and operations. These transit fleet management technologies will be discussed:

- automatic vehicle location systems (AVL)
- transit telecommunications
- transit operations software
- paratransit computer-aided dispatch (CAD)

Electronic fare payment

Electronic fare payment is electronic communication, data processing, and data management of a fare system and replaces the need for cash or exact change for fare payment.

- This technology also provides an option for multiple use of payment media; e.g. parking, shopping.
- Cash handling costs and theft are lower with an electronic fare payment system.
- The cash float on the electronic fare payment media contributes to significant gains in revenue for the transit industry.

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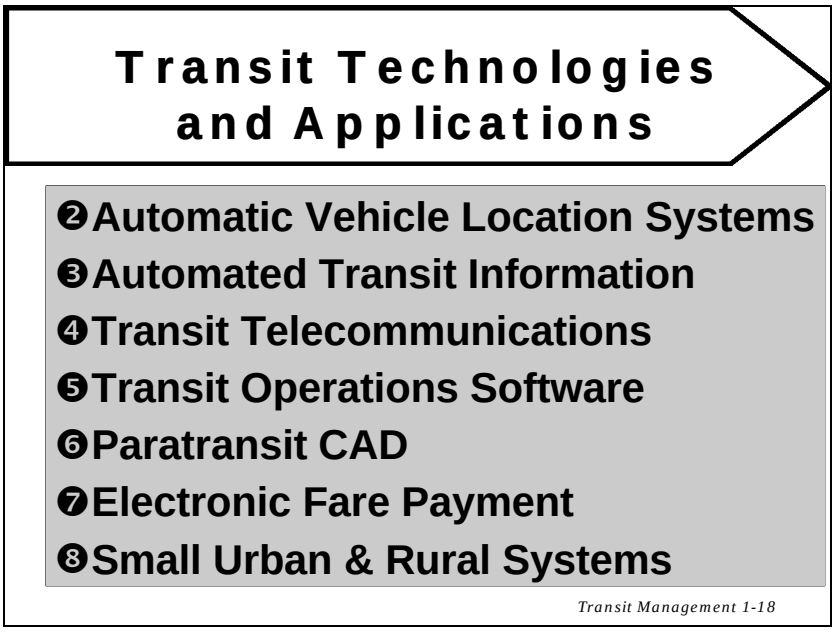
APTS Technologies, Continued

Slide: Transit Technologies and Applications



Automatic Vehicle Location Systems

Module 2: Automatic Vehicle Location Systems covers AVL and the ability to provide real-time location of vehicles by using Global Positioning System, signposts, or dead-reckoning.

Automated Transit Information

Module 3: Automated Transit Information explains how a transit information center receives up-to-date transit information and makes it available to a traveler before the trip and en route.

Transit Telecommunications

Module 4: Transit Telecommunication focuses on technologies and strategies to meet issues regarding the limited capacity of the electromagnetic spectrum. New technologies will require innovative strategies to maximize available spectrum.

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APTS Technologies, Continued

Transit Operations Software	Module 5: Transit Operations Software discusses the capability to automate, streamline, and integrate many transit functions and modes. Computer applications such as computer-aided dispatching and data acquisition (and the APTS technologies which provide the data to them) can improve the effectiveness of operations dispatching, scheduling, and other agency functions.
Paratransit CAD	Module 6: Paratransit CAD covers how real-time information from computer-aided dispatching (CAD) systems enables rerouting demand-responsive paratransit vehicles.
Electronic Fare Payment	Module 7: Electronic Fare Payment deals with eliminating the need for cash or exact change by using a system (e.g., a card or other payment media) for fare payment on different modes and for different carriers.
Small Urban and Rural Transit Technologies	Applying ITS technologies to existing services used in small urban and rural areas, such as demand response and feeder services, is the subject of Module 8.

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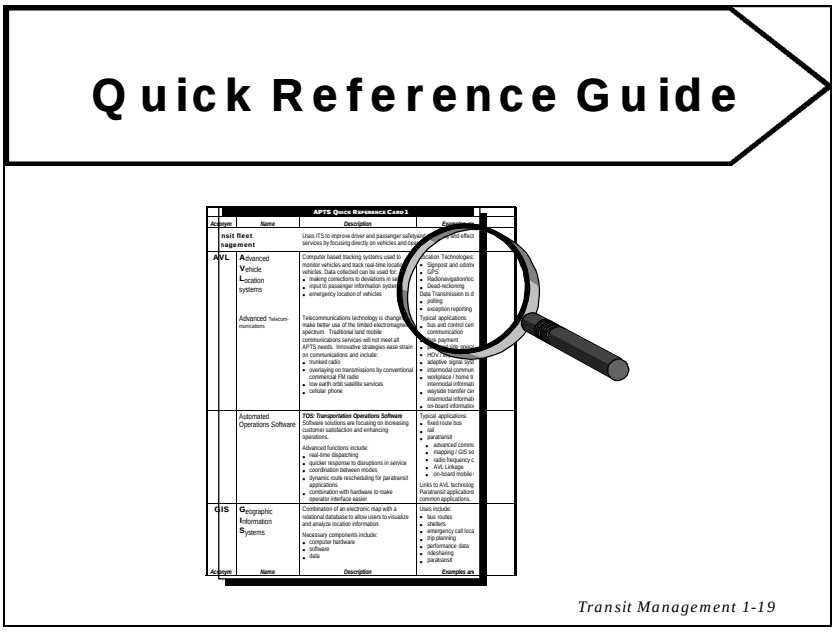
APTS Technologies, Continued

Slide: Quick Reference Guide



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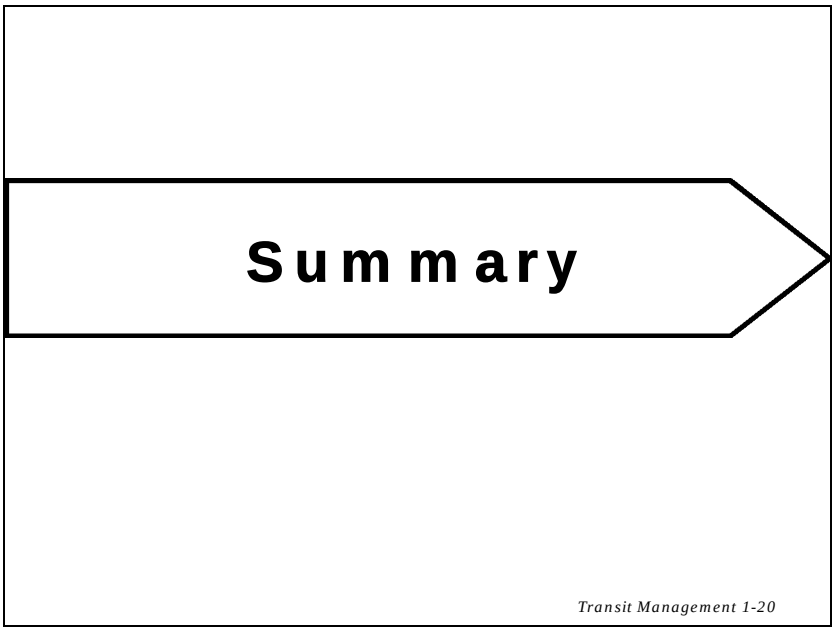
APTS Technologies, Continued

Slide: Summary



Where to go next

For follow up to this module, additional courses are shown below.

Transit Management Training Course	Title	ITS Professional Capacity Building		
		Technical Seminars	Short Courses	NTI course
Module 1: Introduction	Intelligent Transportation Systems Awareness Seminar	x		
	ITS/CVO Awareness Seminar	x		
	ITS in Transit	x		
	Advanced Transportation Management Technology Workshop		x	
	Intelligent Transportation Systems for Transit: Solving Real Problems			x
	NTI Fellows Program			x

APTS QUICK REFERENCE CARD 1

Acronym	*Name*	*Description*	*Examples and Uses*
Transit fleet management		Uses ITS to improve driver and passenger safety and efficiency and effectiveness of services by focusing directly on vehicles and operations.	
AVL	**A**utomatic **V**ehicle **L**ocation systems	Computer based tracking systems used to monitor vehicles and track real-time location of vehicles. Data collected can be used for: • making corrections to deviations in service if used with Transit Operations Software such as Computer Aided Dispatch (CAD) • input to passenger information systems • emergency location of vehicles	Location Technologies: • GPS • Signpost and odometer • Radionavigation/location • Dead-reckoning Data Transmission to dispatch: • polling • exception reporting
	Advanced Telecom-munications	Telecommunications technology is changing to make better use of the limited electromagnetic spectrum. Traditional land mobile communications services will not meet all APTS needs. Innovative strategies ease strain on communications and include: • trunked radio • overlaying on transmissions by conventional commercial FM radio • low earth orbit satellite services • cellular phone	Typical applications: • bus and control center communication • fare payment • park and ride operations • HOV / express lane access • adaptive signal systems • intermodal communications • workplace / home transit and intermodal information • wayside transfer center transit and intermodal information • on-board information

	Transit Operations Software	***TOS: Transit Operations Software***
		Software solutions are focusing on increasing customer satisfaction and enhancing operations.
		Advanced functions include:
		• real-time dispatching
		• quicker response to disruptions in service
		• coordination between modes
		• dynamic route rescheduling for paratransit applications
		• combination with hardware to make operator interface easier
			Typical applications:
			• fixed route bus
			• rail
			• paratransit
			  • advanced communication
			  • mapping / GIS software
			  • radio frequency communications
			  • AVL Linkage
			  • on-board mobile data terminals
			Links to AVL technology and paratransit applications are the most common applications.

APTS QUICK REFERENCE CARD 1

GIS	**G**eographic **I**nformation **S**ystems	Combination of an electronic map with a relational database to allow users to visualize and analyze location information. Necessary components include: • computer hardware • software • data	Uses include: • bus routes • shelters • emergency call location • trip planning • performance data • ridesharing • paratransit
Acronym	***Name***	***Description***	***Examples and Uses***
Electronic fare payment		Electronic fare payment systems integrate card technology, communications, information systems, and electronic funds transfer systems to improve fare payment convenience and reduce fare system costs.	

	Automated Fare Payment	Advances in Automated fare payment are making possible:
		• more sophisticated fare pricing systems, based on distance traveled or time of day
		• reduction of cash and coin handling and the associated costs
		• improved security
		• automation of accounting processes
		• improved reliability of fare boxes (no moving parts)
			Smart Cards in use:
			• magnetic stripe card
			  • WMATA, LA MTA, NYC MTA and others
			• contact chip card
			  • several universities, phone card companies, and Atlanta MARTA
			• RF proximity card
			  • partnerships with Visa Cash, Ventura County, WMATA GO Card

	Multicarrier or Multiuse or Integrated Payment System	Integrating the payment system of one transit operator with that of another entity, such as: • transit operators • human service benefits programs • electronic toll collection systems • bank card systems	Efforts at integration are underway by King County Metro in Seattle, San Francisco Bay Area MTC, Greater Cleveland Regional Transit Authority, and others
Regional multimodal traveler information systems		Information on multiple transportation modes to help decision making of traveler.	

APTS QUICK REFERENCE CARD 1			
	Automated Transit Information	Information provided to the traveler includes: • transit routes • schedules • fares • schedule updates • real-time arrival/departure times • stops • connections	Where it's happening: • Pre-trip • In-Terminal/Wayside • In-Vehicle Access media: • telephone (most common) • monitors • cable TV • variable message signs • kiosks • personal computers (internet) • hand held devices
	Multimodal Traveler Information	Sharing and integration of Traveler Information Systems between modes.	Multi-jurisdictional cooperation

QUICK REFERENCE CARD 2: OTHER APTS APPLICATIONS AND TECHNOLOGIES

Other Transit information systems

Acronym	*Name*	*Description*	*Benefits*
	Mobility Manager	A centralized office through which riders or agencies can book trips on at least two modes • billing is facilitated by Automated Service Coordination • formerly known as "Mobility Manager"	• integration and coordination of transportation services offered by multiple providers • greater economies of scale gained by smaller agencies • excess capacity used by the cooperating agencies • transit and HOV services are more appealing alternative modes
	Real-time Ridesharing	Individual trips arranged on short notice, typically in private autos, although vans and taxis may be included • also known as dynamic or single-trip ridesharing • the traveler initiates a request to the central database • the database searches for a match with rides offered by drivers registered for the program • car or van pooling, or other rides arranged in advance, or on a regular basis are not included	• enables commuters to take advantage of time savings of HOV lanes • provides quickly obtainable alternative mode of travel • people have more choices

Other Transit fleet management technologies

QUICK REFERENCE CARD 2: OTHER APTS APPLICATIONS AND TECHNOLOGIES			
	In Vehicle Diagnostics	The continuous automatic measurement and reporting of real-time vehicle component status • no driver intervention in reporting conditions to dispatch • out-of-tolerance conditions must be passed to dispatch in real time • also known as automatic vehicle monitoring or vehicle component monitoring Vehicle components include: • engine oil pressure • engine temperature • electrical system • tire pressure	• quicker notification of mechanical problems with the vehicles reduces maintenance costs • increases overall dispatch and operating efficiency • more reliable service, promoting increased customer satisfaction • quicker response to or prevention of service disruption • inputs to passenger information systems on service disruptions • properly maintained buses pollute less
Acronym	***Name***	***Description***	***Benefits***
	Traffic Signal Priority	A means of giving high occupancy vehicles (especially buses) and emergency vehicles priority at traffic signals by advancing the green signal phase or extending the green phase in order to minimize the HOV delay • also known as adaptive signal timing • priority may be actuated manually or automatically	• increased schedule adherence • more reliable service, promoting increased customer satisfaction • improves commuter time over private vehicles • improves run times • less idling and stopping saves on energy costs
	Automated HOV facility monitoring	Techniques for identifying the number of passengers in a vehicle to facilitate HOV enforcement • measures run times	• enables transit to obtain comparative time advantages over private vehicles • planners can accurately gauge run times if HOV lanes are not congested • improved schedule reliability and operating efficiency

QUICK REFERENCE CARD 2: OTHER APTS APPLICATIONS AND TECHNOLOGIES			
TMC	**T**ransportation **M**anagement **C**enters	A facility that combines traffic and public transit operations, communications, and/or control; in a "virtual" TMC, traffic and transit facilities share real-time information in order to enhance each operation without being housed in the same physical location • Direct communications and subsequent decision-making can occur readily between the respective operators during peak traffic periods • Can be critical in developing traffic signal priority systems for transit vehicles • TMCs without transit information are still called traffic management centers	• direct communication with emergency services increases customer and operator security and safety • improves schedule reliability and operating efficiency • links freeway, traffic and transit information and operations • enhances transit stature and ensures that transit receives ample consideration within the regional transportation policy
APCs	**A**utomatic **P**assenger **C**ounters	An automated means for collecting data on passenger boardings and alightings by time and location. • Most new APCs are incorporated or considered in AVL systems • APCs are much lower in cost than manual checkers	Data is used for: • planning • future scheduling • decisions on corrective actions • reporting

Exercise 1-1: APTS Quick Reference Card

In this exercise You will:
- discuss and select the transit technologies that are of most interest to you

Directions Read Quick Reference Card 1. Circle the three items which seem most interesting to you.

Continued on next page

Exercise 1-1: APTS Quick Reference Card, Continued

Question 1 How could your agency or agencies in your region benefit from each technology? List three ways.

Question 2 List three risks associated with the technology.

Question 3 What integration issues will you face in your region with these technologies?